

## METHOD AND APPARATUS FOR LASER SURGERY OF THE CORNEA

### ABSTRACT OF THE DISCLOSURE

A laser-based method and apparatus for corneal surgery. The present invention is intended to be applied primarily to ablate organic materials, and human cornea in particular. The invention uses a laser source which has the characteristics of providing a shallow ablation depth (0.2 microns or less per laser pulse), and a low ablation energy density threshold (less than or equal to about  $10 \text{ mJ/cm}^2$ ), to achieve optically smooth ablated corneal surfaces. The preferred laser includes a laser emitting approximately 100-50,000 laser pulses per second, with a wavelength of about 198-300 nm and a pulse duration of about 1-5,000 picoseconds. Each laser pulse is directed by a highly controllable laser scanning system. Described is a method of distributing laser pulses and the energy deposited on a target surface such that surface roughness is controlled within a specific range. Included is a laser beam intensity monitor and a beam intensity adjustment means, such that constant energy level is maintained throughout an operation. Eye movement during an operation is corrected for by a corresponding compensation in the location of the surgical beam. Beam operation is terminated if the laser parameters or the eye positioning is outside of a predetermined tolerable range. The surgical system can be used to perform surgical procedures including removal of corneal scar, making incisions, cornea transplants, and to correct myopia, hyperopia, astigmatism, and other corneal surface profile defects.